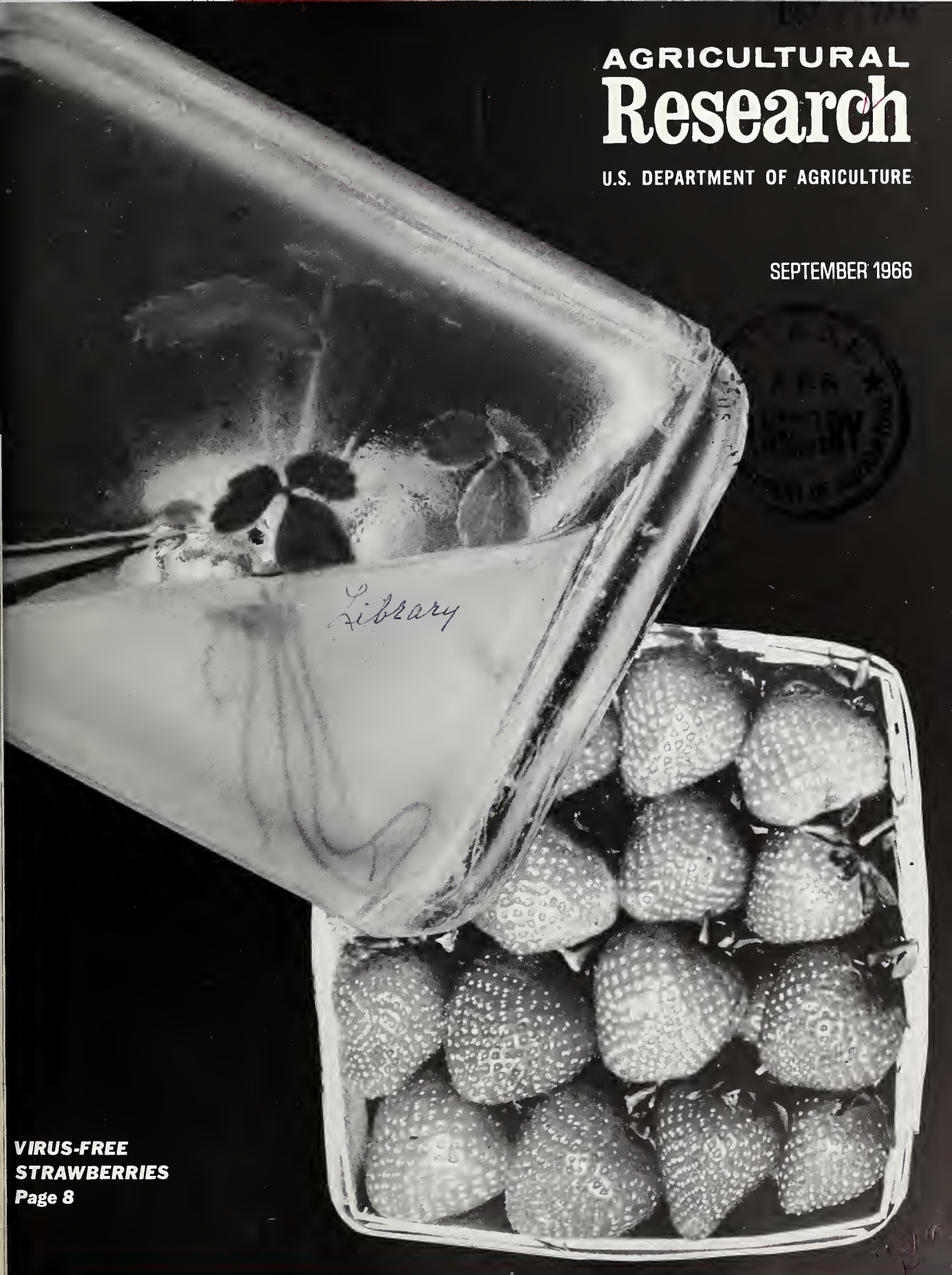

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VIRUS-FREE STRAWBERRIES

Page 8

AGRICULTURAL
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Scientific Ingenuity

Ingenuity plays a vital part in all agricultural research.

It leads scientists to unusual solutions to knotty problems such as the one researchers at Auburn, Ala., faced recently. They needed a way to separate coccidia—tiny, one-celled parasites—in a drop of water viewed under a microscope.

Parasitologist L. R. Davis and technician G. W. Bowman came up with the answer—a micromanipulator which they built in less than 30 minutes (page 13). Its parts—a rubber stopper, a microscope slide, a pipet, and plastic tubing—cost less than $1.

Other scientists can build and use the micromanipulator. It also could be built and used by high school and college science classes.

One ingenious development often leads to another. Plant breeders, for example, needed a better test for winter-hardiness in oats. Working with State scientists in the Northeast, ARS research agronomist H. G. Marshall developed a fast, accurate, and simple test (AGR. RES., December 1964, p. 15).

Recently, researchers O. A. Vogel and D. W. George at Pullman, Wash., modified Marshall's technique. The result—a test for winter-hardy wheat (page 4) that is more accurate than field observations and much faster than the freezer test formerly used.

Other results of scientific ingenuity will continue to benefit the developers and other scientists. They include:

- A microreactor built from a soldering gun (page 15). Used to react vegetable oil with a gas, it cuts the time needed for one analysis procedure from 1 week to 1 hour, saving about $35,000 per year for the Northern utilization research laboratory in Peoria, Ill.
- A pollen trap made of a clothespin, a plastic tag, and a piece of cellulose tape (page 16). Easier to use than other traps, it provides accurate pollen counts for tree breeding research.
- An attachment that adapts a mechanical picker for cotton test plots (page 13). With it, scientists can harvest a 50-foot row in about 2 minutes, compared to 1 hour or more to handpick the same row.

Editor: R. P. Kaniuka
Managing Editor: H. K. Street
Contributors to this issue:
C. E. Bower, H. L. Brinson, E. H. Davis, C. L. Gaddis, D. W. Goodman, M. E. Haun, M. B. Heppner, D. H. Mayberry, J. G. Nordquist, J. M. Singer, D. F. Warren, A. D. Wynn

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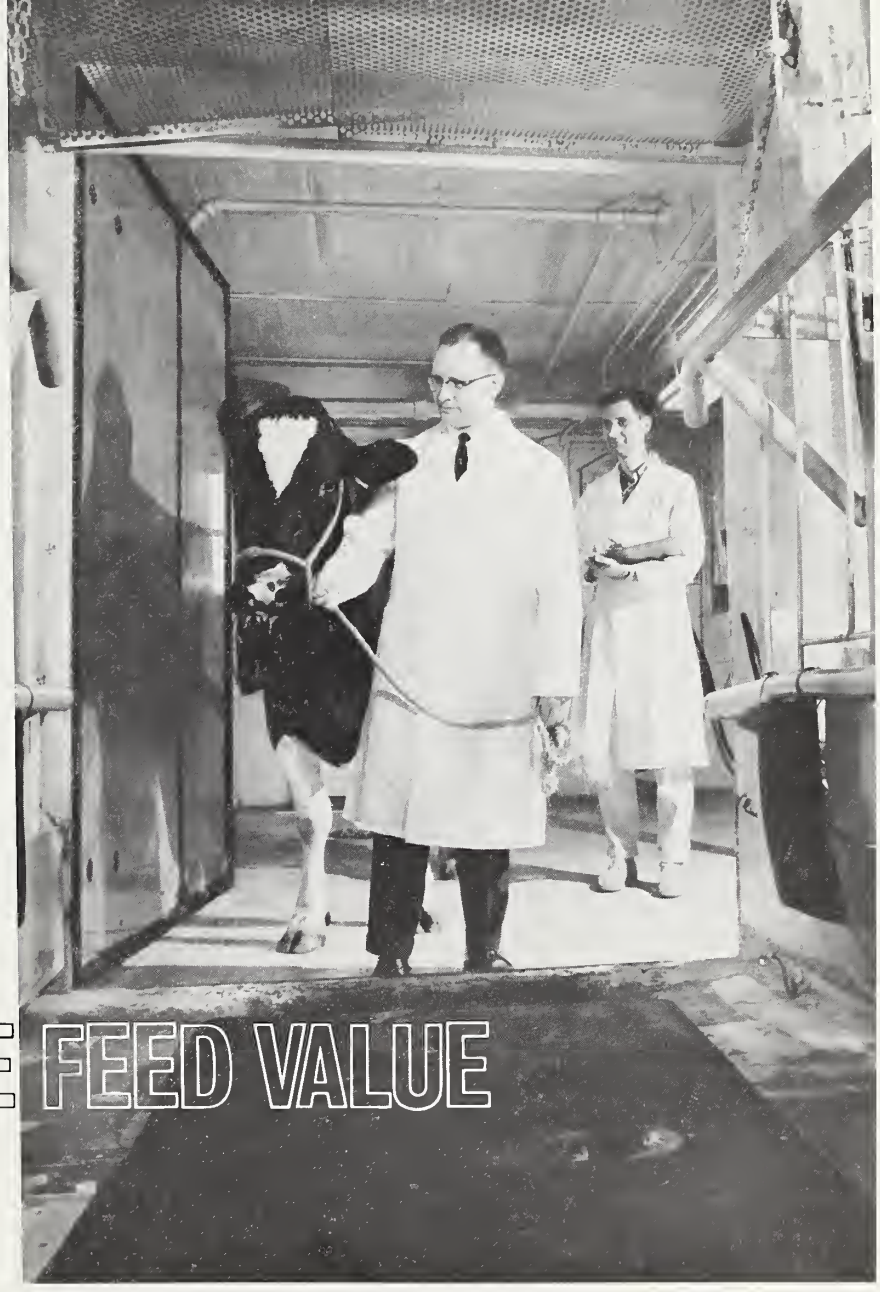
Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Net Energy Concept
New Laboratory Method

DETERMINE FEED VALUE



Animal nutritionist W. P. Flatt leads Lorna, the cow used extensively in ARS energy metabolism studies, into isolation chamber as feed chemist P. J. Van Soest watches. (*Photo No. ST–1343–16*)

FARMERS AND ANIMAL nutritionists may discard the familiar concept of TDN (total digestible nutrients) for measuring the value of livestock feed in favor of a more useful concept, NE (net energy), made practical by ARS animal nutritionist W. P. Flatt.

And instead of traditional laboratory methods for determining feed value, nutritionists may use a new, more precise system developed by ARS feed chemist P. J. Van Soest.

Although neither Van Soest nor Flatt plans to publish tables of feeding standards or feed evaluations, future reference works may use their methods and terminology. Flatt's system would be useful for determining major differences between different types of rations; Van Soest's formula for smaller differences.

In trials at Beltsville, Md., Flatt compared the value of TDN measurement to that of NE by sealing cows inside isolation chambers and determining how much feed energy is given off as liquids and gases; how much

is used for body maintenance; how much is deposited in the body as meat and fat; and how much is finally available for milk production.

He found that two feeds equal in TDN might differ in the proportion of nutritive value going to productive use. A farmer would obviously prefer a feed with more milkmaking power to one resulting in more urine or gases.

Flatt calls this milkmaking power the net energy (NE) of a feed. For beef cattle, NE can also express a feed's potential for meat production.

A dairy farmer, for example, might calculate the energy produced by a feed in order to add forage to a ration to replace part of the concentrates.

Since NE reflects milkmaking power more accurately than TDN, a calculation based on NE would be more certain to maintain milk production than one based on TDN.

Determining the NE of a feed under Flatt's system of sealing a cow inside a chamber requires much time and labor even with computerized equipment. Van Soest developed his new method to simplify feed evaluations (AGR. RES., November 1965, p. 5).

One of the traditional systems which Van Soest's method may replace, the 100-year-old Weende system, attempts to imitate an animal's digestive processes by chemistry. It yields two fractions called "nitrogen-free extract" (NFE) and "crude fiber" (CF).

NFE is relatively digestible, and CF is relatively indigestible. The Weende system is inaccurate, however, because NFE contains some feed components such as lignin which cattle cannot digest; and CF includes some fibers such as cellulose which cattle digest easily.

Instead of trying to duplicate natural digestion, Van Soest based his system on the structures of the plants he analyzes. He found that the cell contents of a plant are almost completely digested by all livestock, and that ruminants also digest cell walls to some extent.

Therefore, to determine overall digestibility of a plant, Van Soest need only determine the digestibility of its cell walls. He calls cell walls "neutral detergent fiber" (NDF) a name based on the process he uses to separate them from cell contents.

Van Soest discovered that the ratio of the fiber lignin to the fiber cellulose provides a close estimate of the digestibility of NDF for ruminants. By laboratory analysis, he first establishes a total value for cellulose and lignin together, which he calls "acid-detergent fiber" (ADF). Then he determines the percentage of lignin in the total ADF, adds this to the value already determined for the cell contents, and gets the total digestibility of the plant.

A comparison of bromegrass and alfalfa hay illustrates the value of Van Soest's system. Samples of grass and legume hay might be found equal in digestibility by the Weende system, because their crude fiber is equal.

However, Van Soest's system would show that even if the grass sample had *more* fiber than the alfalfa, it might still be more digestible to a ruminant because the proportion of digestible fiber (the proportion of lignin in ADF) is greater in the grass.

Van Soest's system requires no more laboratory work than the Weende system. Thus, the new method is practical not only for research but also for feed quality control work and rapid testing of samples submitted by farmers who wish to pinpoint the feeding value of their forages.

And the detergent system works easily on mixtures of different feeds such as those in pellets. A meaningful digestibility estimate on mixes is much more difficult to obtain from a Weende analysis. ■

NEW TEST FOR WINTER-HARDY WHEAT

A NEW TEST FOR WINTER hardiness of wheat has been developed by ARS research agronomists O. A. Vogel and D. W. George in cooperation with Washington State University at Pullman.

The new test is more accurate, faster, and takes less freezer space than the test that plant breeders now use to screen plant material for developing new strains of wheat.

Vogel and George modified a technique which ARS agronomist H. G. Marshall developed to predict winter hardiness in oats (AGR. RES., December 1964, p. 15).

For their test, the scientists dig field-grown wheat seedlings, cut off the tillers at the soil line, and remove the crown roots. They seal the crowns in plastic bags, freeze them, and then thaw them. Hardiness is determined by tiller regrowth during a recovery period of a specified length of time.

Data from this method are available within 3 days and as many as 100 varieties or breeding lines can be tested at one time. The method is also flexible—plants can be held in refrigerated storage for 3 to 5 days before testing and for as long as 7 days afterward. This flexibility may make it possible to evaluate regional nursery plantings at a central location, the scientists say.

In former tests for winter hardiness, wheat was frozen while growing in pots or flats. ■

With Rats Fed Balanced Rations

RESTRICTED DIET INCREASES ACTIVITY

Physiologist R. A. Ahrens observes rat in cut-away exercise wheel used for illustration purposes. (*Photo No. ST–1342–21*)

WHEN A DIETER cuts the number of calories he eats, does the restricted diet make him more or less active?

Scientists don't yet know the answer to this question, but are closer to it as a result of ARS nutrition research.

In trials at Beltsville, Md., physiologist R. A. Ahrens fed rats diets balanced much the same as those eaten by typical American families. Rats got cornstarch to represent starchy foods; beef tallow and corn oil as fats and oils; and an adequate supplement of proteins, vitamins, and minerals.

Rats on the restricted diet got only 60 percent as many calories as the liberally fed rats. Both groups received the same amounts of proteins, vitamins, and minerals.

Even though all animals were still growing in size, rats on the restricted diet gained an average of 33 grams each in the 31-day test period. The liberally fed rats gained more than 2½ times as much as the others—an average of about 87 grams each.

Both groups had access to an exercise wheel, and their activity was determined by automatic counters that measured the revolutions. The rats were not forced to exercise; they could run in the wheel, or relax in their cages, as they pleased.

Exercise taken by both groups was equal at night, when rats are normally most active. But during the day, while the well-fed animals rested, those on the restricted diet ran in the wheel almost as much as at night.

During a 24-hour period, rats on the restricted diet averaged 9,790 spins of the wheel, while liberally fed rats averaged only 5,870 spins. The more active rats seemed to nap around the clock instead of sleeping for long periods in the daytime.

In future nutrition research, ARS plans to investigate the precise interactions of factors other than caloric intake and exercise that affect body weight. These factors include the type of food, the major carbohydrate in the food (sugar or starch), the kind of weight changes that result (loss of fat, protein, water), and the overall effect of these changes on physical health. ■

FOR MECHANIZED CITRUS HARVEST

ARS AND STATE researchers are cooperating to mechanize citrus fruit harvesting.

• ARS agricultural engineer Joseph Molitorisz has used electricity experimentally to weaken the attachment of ripe oranges to trees.

• Molitorisz also developed a power ladder that makes hand picking more efficient and speeds it by 30 percent.

• ARS agricultural engineer S. L. Hedden and G. E. Coppock of the Florida Citrus Commission and the University of Florida Citrus Experimental Station are developing a catching system for harvesting fruit destined for processing. The scientists believe it has the most promise of all mechanical citrus harvesting systems tested so far.

Wiring Trees

In research in cooperation with the University of California at Riverside, Molitorisz used electricity to overcome a basic problem in citrus harvesting—the fact that citrus trees do not readily drop their fruit.

Molitorisz inserted a positive electrode into the trunk and a negative electrode into the top branch of an orange tree. He applied 58 volts of direct current, and within 2 weeks new growth appeared. When the engineer reversed the direction of the current, the branch shriveled and dried up.

To confirm this reaction, Molitorisz cut 12 citrus branches and placed the ends between wet sponges. He saturated the sponges at one end of the branches with a nonconductive dye. Of the 12 branches, 6 were charged with 58 volts of direct current; the other 6 were not.

After 18 hours, Molitorisz found that the dye in uncharged branches moved less than one-quarter of an inch. The dye traveled the entire length of the charged branches, and its channel of flow also was clearly visible.

Then, Molitorisz reversed polarity at the point on an orange tree where the stem and fruit come together. The branch dropped most of its mature fruit but held onto green fruit.

The results suggested clearly that a living tree has a natural electrical current. They also indicated that applied current that follows the same direction as natural current will speed up sap flow, causing rapid growth. On the other hand, when current is applied to oppose the natural flow within the tree, growth is slowed.

A grove of orange trees at the university has been "wired" for further study. Molitorisz points out that years of research will be needed before this intriguing electrical process can be fully understood and employed in orchards.

Power Ladder

The power ladder, which Molitorisz built with the assistance of engineering technician Scott Durrell, is now available commercially.

The machine—a tricycle-type vehicle with a fixed boom—is powered by a 6-horsepower gasoline engine. The worker rides on a platform on rollers that moves up and down the fixed boom. He uses foot pedals to control the movement of the vehicle around the tree, and thus has both hands free for picking.

The worker places the fruit in a hopper mounted on the front of the platform. When the hopper is filled, the worker descends halfway to the ground, lowers the hopper, and lets the fruit roll into a removable field bin. He then moves to the other side of the tree or to another tree and continues picking. The ladder has connections for using pruning tools.

Engineer Joseph Molitorisz watches as picker Luis Moya uses power ladder Molitorisz developed. (Photo No. PN–1399)

Fruit Catcher

The harvesting system being developed in Florida shakes fruit from trees, catches it, and conveys it to baskets. When the system was tested on fairly level terrain, the 4 men who operate it harvested as much fruit in a given time as 10 handpickers.

The harvester includes two catching frames, each about 26 feet long and 15 feet wide and sloped 20 degrees. On each frame is mounted a metal boom that grips and shakes the fruit tree. A conveyor is part of one frame.

The frames, which are tractor-drawn, are positioned on both sides of a tree so that each slopes toward the tree. Fruit which the metal booms shake loose rolls down both frames and onto the conveyor, which carries it into baskets on a platform at the rear of the machine. When baskets are filled, they are rolled from the platform, deposited on the ground, picked up by a boom-type loader, and emptied into a truck.

In tests at Lake Alfred, Fla., last year, the device harvested more than 85 percent of grapefruit and early and mid-summer orange varieties at an average of 12 trees per hour. The shaking action had no adverse effect on tree vigor or on subsequent fruit yields.

Figuring initial machine costs, operation, depreciation, interest, taxes, repairs, and miscellaneous costs, the engineers estimate the harvest cost with their machine at $2.17 per tree. Cost per box, they say, depends on the yield of each tree. For orange trees yielding 8 boxes per tree the cost is about 33 cents per box; and grapefruit yielding 20 boxes per tree costs about 11.5 cents per box.

These costs also include gleaning the fruit left after the harvester moves on. The costs do not include pruning which, the researchers think, would increase efficiency of fruit removal and rate of harvest.

Hedden and Coppock are still refining their harvesting system. It is not yet available commercially. ■

Fruit catching machine developed by ARS engineers is shown in use in Florida citrus grove. Metal arms shake tree and frames catch fruit which is conveyed to bin at rear of machine. (Photo No. PN–1400)

ON THE COVER

Stem cutting grown in sterile nutrient agar becomes a tiny strawberry plant. (Photo No. PN-1401)

Cutting tiny tip from plant runner is first step in producing virus-free strawberries. (Photo No. ST-364-25)

From Tiny Cuttings, Scientists Produce . . .

VIRUS-FREE STRAWBERRIES

By growing tiny plants from tips of stem tissue that can barely be seen, ARS scientists produce virus-free strawberries from infected plants.

Plant pathologist J. G. McGrew at Beltsville, Md., is using this technique to produce plants of the variety Suwannee that are free of latent-C virus, one of the more serious and widespread of the 25 strawberry viruses.

Suwannee will be the first formerly infected variety made free of latent-C virus to reach growers. Although it keeps too poorly to be of value to commercial growers, Suwannee is considered the best flavored of all strawberry varieties. In the past, it was a favorite of home gardeners, but, because plants were weakened by latent-C virus, the variety has almost disappeared from cultivation.

Formerly, virus-free strawberries were propagated from plants that by chance had escaped infection. Researchers, however, had been unable to locate virus-free stock of a few important varieties, including Suwannee.

To produce the virus-free Suwannee, McGrew held virus-infected plants in a growth chamber heated to 95 degrees F. for 14 to 28 days. Heat, the pathologist explains, seems to prevent the virus from moving into the tips of the plants' runners.

From 10 plants, McGrew made 90 cuttings, 1/16- to 1/4-inch long, from the tips of the runners. These he placed on sterile nutrient agar. Twenty-one survived and, within 30 to 60 days, each developed 3 or 4 strong roots.

McGrew transplanted these tiny plants to soil in a greenhouse. Eighteen survived transplanting, and McGrew tested the survivors for virus infection. Fourteen were free of latent-C virus.

ARS releases virus-free plants produced by this technique to State departments of agriculture and experiment stations. These agencies maintain certification programs in which the plants are increased and redistributed to selected nurserymen. The nurserymen, in turn, propagate the plants for sale to commercial growers and home gardeners. ■

Plant is placed in jar with sterile nutrient agar. (Photo No. ST-364-13)

Plant Pathologist J. R. McGrew inspects cuttings growing in agar. (Photo No. ST-363-19)

McGrew removes the tiny plant from agar. (Photo No. ST-365-12)

McGrew grows plants in heat chamber and tests those that survive for freedom from virus. Virus-free plants thus produced are stock for propagation. (Photo No. ST-363-25)

EFFECT OF DIET ON LAYING HENS			BODY WGT. at 20 wks.	FEED CONSUMPTION 8-20 wks.	DEATHS by 20 wks.	AGE, FIRST EGG	AVERAGE WGT. DOZEN EGGS	FEED/DOZ. EGGS
0-8 wks.	8-20 wks.	20+wks.						
(percentage protein)			(lbs.)	(lbs.)	(percentage)	(days)	(ozs.)	(lbs.)
21	16	16	2.89	11.89	1.9	148	25.9	5.5
16	16	16	2.83	12.39	3.2	151	26.3	5.0
16	12	16	2.74	12.26	3.0	152	26.0	4.9
12	12	16	2.43	11.48	5.4	157	26.4	5.1
16	12	12	2.74	12.26	3.0	152	25.3	5.8
21	12% protein 25% hulls	16	2.74	16.74	2.7	149	24.5	5.7
21	16% protein 25% restricted	16	2.37	9.48	7.6	171	26.0	5.5

From 8 to 20 Weeks of Age . . .

Chickens do Well on Low-Protein Diet

Farmers may be able to cut the cost of raising laying hens by feeding them a ration with less protein than normal from 8 to 20 weeks of age.

In a 5-year study at Beltsville, Md., ARS poultry nutritionists R. J. Lillie and C. A. Denton found that chickens fed a low-protein diet (12 percent) from 8 to 20 weeks of age grew as well as those on the normal protein ration (16 percent). Both groups had about the same death rate.

And although chickens on restricted rations—particularly those low in energy—usually eat larger meals to compensate for the deficiency, birds in these two test groups ate about the same amounts of feed.

In this experiment, the low-protein ration cost about 3 cents per pound, and the regular ration, 4 cents. Actual savings to farmers using a low-protein ration, however, would depend on the fluctuating prices of feed ingredients.

After the chickens were placed in laying houses at 20 weeks, both groups received the normal protein ration. Chickens in both groups produced the same numbers of eggs and were about equal in feed efficiency, body weight, egg weight, fertility and hatchability of fertile eggs, and death rate.

While the birds did well when fed the low-protein ration from 8 to 20 weeks of age, Lillie and Denton found that chickens need a normal ration from birth to 8 weeks and during the laying period.

Birds fed the 12-percent ration from the time they hatched ate more feed but did not grow as well as those on a normal protein diet during this period. Even though their ration was changed to 16 percent when they were 20 weeks old, these chickens never caught up with those started on normal protein. Such undersized birds, the scientists say, are particularly susceptible to stress.

Birds kept on the low-protein ration only after they started laying produced fewer eggs with lower weight and ate more feed per dozen eggs produced than layers that received a normal protein ration.

Lillie and Denton also tested feeds that had been "bulked" by adding 25 percent oathulls and diets that were cut back in quantity to 75 and 80 percent of what a chicken would normally eat.

All proved impractical. Chickens ate more to offset the bulk provided by the oathulls. And, the researchers found that the work of adjusting the amount of feed cost more than the saving from using less feed when they fed a 70-percent diet.

Although research at other stations had shown that an 8- to 20-day delay in sexual maturity increased initial egg weight, the ARS scientists found no such effect in their trials.

When fed from hatch to 20 weeks, the 12-percent protein ration delayed maturity by 9 days, and diets restricted in quantity delayed maturity by about 15 days. The first eggs laid by chickens on these rations did not outweigh or outnumber those of chickens fed normal diets. ■

In Basic Research,
Scientists Learn . . .

Why Insects Eat Weeds

The three-lined potato beetle feeds on leaf from host plant. The beetle's egg cluster is at lower right. (Photo No. PN–1402)

IN MANY COUNTRIES, including the United States, weed-eating insects have proved valuable for weed control.

ARS scientists are now trying to learn *why* these insects choose their host plants. Their basic research may lead to wider and more effective use of insects as a biological weapon against weeds.

An example is research on the green dock beetle and the three-lined potato beetle, conducted by entomologist D. C. Force at Albany, Calif., in cooperation with the California Agricultural Experiment Station.

Force chose these insects for study because their main host plants are weeds, and because they have restricted feeding and egg-laying habits, and are easily raised in laboratories. Both are leafeaters, develop rapidly, and deposit their eggs in conspicuous clusters.

In his studies, Force gave the insects access to various plants to learn how particular they were in choosing their diets. He found that the insects will feed to a limited extent on plants that are poisonous or nonnutritious and will lay eggs on plants unsuitable for larval development.

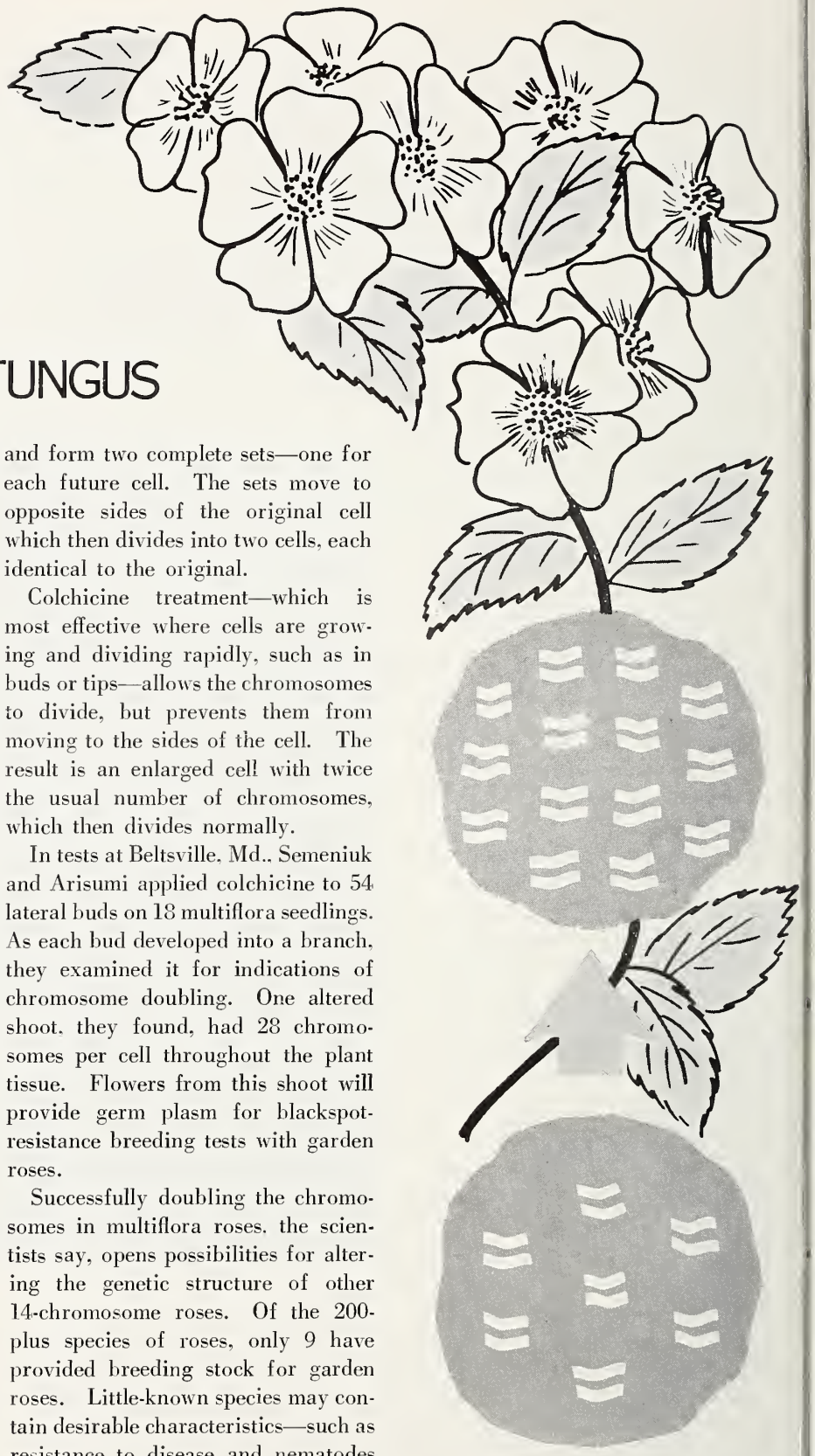
When he tested synthetic diets, Force found that larvae and adults of the dock beetle responded while larvae and adults of the potato beetle did not. This, he concluded, indicates that the dock beetle is attracted by some chemical in the host plant.

Force was not able to determine whether plants give off scents that attract the insects. When placed in a cage with a fan at one end, the insects found a plant rapidly when it was upwind; slowly or not at all when it was downwind. But the insects moved upwind even when there were no plants in the cages.

In future research, scientists will try to learn how the habits of weed-eating insects are influenced by the size, shape, color, and texture of plant parts; by nutrients in plants; and by chemicals in plants that may attract, repel, or stimulate insects. ■

Doubling Chromosomes Leads to . . .

ROSES FREE OF FUNGUS



BLACKSPOT—a fungus disease of roses that plagues many home gardeners—may soon be overcome by crossing an artificially altered multiflora rose with garden varieties.

Rose breeders previously had found one multiflora rose selection that was resistant to blackspot fungus organisms. Until now, its chromosome number was such that when it was crossed with ornamental varieties sterile offspring were produced.

Roses have multiples of 7 chromosomes in their cells—beginning with 1 pair of each, or 14 chromosomes. The multiflora rose, for example, has 14 chromosomes. Garden roses, however, have 2 pairs of each of their 7 chromosomes, 28 chromosomes in all. When the 2 types are crossed, a sterile 21-chromosome plant results.

But by doubling the number of chromosomes in the cells of the multiflora rose, ARS horticulturist Pete Semeniuk and plant geneticist Toru Arisumi believe they have made it compatible with garden varieties.

Semeniuk and Arisumi altered the multiflora rose by treating it with colchicine, used to alter and improve other plants (AGR. RES., May 1958, p. 11), but previously unsuccessful with roses.

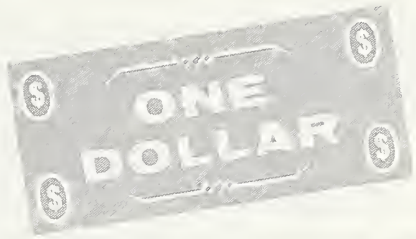
Colchicine doubles the number of chromosomes in plant cells by interrupting cell division at a vital stage. Normally, before a cell divides, it enlarges and its chromosomes divide and form two complete sets—one for each future cell. The sets move to opposite sides of the original cell which then divides into two cells, each identical to the original.

Colchicine treatment—which is most effective where cells are growing and dividing rapidly, such as in buds or tips—allows the chromosomes to divide, but prevents them from moving to the sides of the cell. The result is an enlarged cell with twice the usual number of chromosomes, which then divides normally.

In tests at Beltsville, Md., Semeniuk and Arisumi applied colchicine to 54 lateral buds on 18 multiflora seedlings. As each bud developed into a branch, they examined it for indications of chromosome doubling. One altered shoot, they found, had 28 chromosomes per cell throughout the plant tissue. Flowers from this shoot will provide germ plasm for blackspot-resistance breeding tests with garden roses.

Successfully doubling the chromosomes in multiflora roses, the scientists say, opens possibilities for altering the genetic structure of other 14-chromosome roses. Of the 200-plus species of roses, only 9 have provided breeding stock for garden roses. Little-known species may contain desirable characteristics—such as resistance to disease and nematodes or improved fragrance—that can be bred into garden varieties. ■

MICROMANIPULATOR for Less Than



FOR LESS THAN a dollar, two ARS scientists have built a device for moving tiny objects under a microscope. It works nearly as well as one that costs over $700.

The device, called a micromanipulator, is being used in coccidiosis research to isolate pure cultures from mixed species of coccidia in a drop of water. Coccidia, one-celled parasites, infest and destroy the intestines of animals and poultry.

Parasitologist L. R. Davis and technician G. W. Bowman at Auburn, Ala., built the micromanipulator in less than 30 minutes from a rubber stopper, a microscope slide, a pipet, and a 2-foot length of flexible plastic tubing.

The scientists glued the larger flat end of the rubber stopper to the glass microscope slide. They placed the pipet in a groove cut in the other end of the stopper and slipped one end of the plastic tubing over the wide end of the pipet.

Using two microscopes, the scientists mount the micromanipulator on the focusing stage of one microscope with the tip of the pipet reaching over to the slide viewed on the other.

By turning the knobs normally used for manipulating the first microscope's stage, the operator moves the tip of the pipet up and down or from side to side.

When the tip of the pipet is dipped into the drop of water being viewed, coccidia near the tip are drawn into it by capillary action. The operator can control this action by holding the free end of the plastic tubing in his mouth and thus regulating the air pressure. ■

The pipet of the micromanipulator reaches into the viewing area of the microscope at right. To steady the tubing, it is run through a drilled hole in the stopper. (*Photo No. PN–1403*)

MECHANICAL HARVEST FOR COTTON PLOTS

ARS SCIENTISTS in California have developed an attachment for rapid harvesting of cotton test plots with a mechanical picker.

Up to now, most experimental cotton has been harvested by hand so that researchers can weigh and sample each row or plot. Earlier, ARS and State scientists at Stoneville, Miss., modified a mechanical picker to bag the cotton from each row or plot separately (AGR. RES., March 1963, p. 13).

With this modification it is necessary to stop the picker periodically to unload, weigh, and test cotton. The attachment designed by agronomist J. H. Turner and research technician C. M. Brown at Shafter, Calif., eliminates this disadvantage.

The researchers hang a milk scale within the cage on the picking machine that collects cotton, and hang a small metal weighing basket on the scale. An elbow duct directs cotton from the machine's picker heads into the weighing basket. The basket is unloaded through a front-opening door.

A scientist standing in the cage of the machine can read the weight from the scale, record it, take cotton samples for testing, and be ready to enter the next test plot in a matter of seconds. The attachment can be installed or removed by two men in about 20 minutes. ■

Mechanical picker attachment includes scale, elbow duct, and basket which holds cotton from each test row or plot. (*Photo No. PN–1404*)

Cooperative Studies Lead to . . .

MULTIPLE USE OF GEORGIA PINE WOODS

It has been like putting a jigsaw puzzle together—correlating the findings of more than 25 years of woodland research by ARS and the Forest Service at the Georgia Coastal Plain Experiment Station in Tifton.

But the pieces of research are fitting together now into a management system for multiple use of 20 million wooded acres—providing food for cattle, quail, and deer; and recreation for man.

ARS and FS scientists in agronomy, animal nutrition, plant genetics, and ecology began work in 1940 to find cheap, fast ways to grow trees, improve forage, increase beef production, and improve wildlife habitat in the Georgia flatlands.

Early in the research, FS began tree thinning to restore and maintain healthy stands of pole and saw log trees closely spaced. Later, trees were spaced more widely so the land could be used for grazing and hunting while the timber grew. Managed stands now produce ½ to 1 cord of pulpwood per acre per year.

FS, ARS, and Georgia Coastal Plain Experiment Station also teamed up for forest grazing research on the Alapaha Experimental Range about 20 miles from Tifton. Forest owners there had grazed cattle on the range the year round. Although the cattle were hardy, their productivity was extremely low and thousands starved to death in the woods each winter.

To increase forage growth in this area, FS burned the native wiregrass and spread fertilizer. ARS introduced new plants and carried on plant breeding programs to develop improved native forage varieties.

About 20 years ago, ARS started cattle breeding to find improved strains suitable for the area. Part Brahma cattle were found more productive in the flatwoods than straight Hereford, Angus, or Shorthorn lines and ARS introduced Brahma strains into carefully controlled breeding programs.

Since that time, the combination of cattle breeding, better nutrition, and improved forage management has raised the annual calf crop of 57 percent and average weaned weight of 272 pounds to the present 76 percent calf crop and 427 pounds weaned weight.

As the trees have grown and interest in wildland grazing has led to the development of a complex management system, the demands on the flatwoods for recreation have increased. Now the area is used for deer and quail hunting, picnicking, and camping.

Other problems—soil mineral deficiencies, poor soil moisture, improper use of fire, and undesirable brush—still prevent full multiple use of the Georgia flatwoods. Research is now underway at the station to solve these problems.

FS scientists are studying ways to prevent growth of saw-palmetto and gallberry, the two plants that impede pine regeneration and forage growth, and to promote growth of important quail food plants such as partridgepea.

FS and ARS, cooperating in testing the use of pasture crops in wide-spaced pine plantations, have found that Pensacola Bahiagrass is shade tolerant and good under pine. They are now planting it along rows of pines selected for rapid growth, small limbs, and good form.

The cooperating scientists are also trying to determine how soon cattle can be turned onto these pastures without damaging excessively the tops of the young pines. ■

Search for Resistant Lettuce

Scientists are searching for lettuce germ plasm with resistance to a newly identified race of downy mildew fungus that is gravely endangering lettuce production in Texas.

The highly pathogenic new race, found widespread last winter over 8,000 acres of lettuce grown in southern Texas, may be a mutation of one of the several races of downy mildew already there. It attacks varieties resistant to other races of the organism.

The use of fungicides to control downy mildew is not always practical. Developing a resistant variety is the chief hope for combating the disease.

After the new race was identified, P. W. Leeper, associate horticulturist of the Texas Agricultural Experiment Substation at Weslaco, screened more than 1,200 breeding lines of lettuce from material furnished by ARS geneticists T. W. Whitaker and G. W. Bohn of La Jolla, Calif., and E. J. Ryder of Salinas, Calif. Leeper found a few resistant to the new race of mildew, but these lines are not yet acceptable as commercial varieties.

When the mutant fungus was discovered, Leeper had growing at Weslaco some 982 different breeding lines from material previously furnished by ARS. None produced a single plant immune to the new race.

Leeper then planted and screened more than 250 plants from other countries supplied by the ARS geneticists. He was unable to infect a few of these. They will undergo further screening before being crossed with adapted varieties.

The breeders can get two lettuce crops a year—a summer crop in California and a winter one in Texas. Once they find a promising strain, they may be able to develop a resistant commercial variety and get it to growers in 4 or 5 years by making crosses in both States and screening them in Texas.

Mildew has very critical moisture and temperature requirements for survival, so its spread, extent, and damage vary widely from year to year. It can knock out 3,000 to 4,000 acres of lettuce in a week to 10 days. Infected wild lettuce in the United States and Mexico could spread the fungus.

Soldering Gun—Microreactor

ARS oil chemists have converted a soldering gun into a microreactor—a precision research instrument.

Holding samples as small as 2 to 3 millionths of a quart, it provides heat to vaporize materials so they can be injected into a gas chromatograph for analysis and identification.

With one procedure, which once took about a week and now takes about an hour, the microreactor saves almost $35,000 a year in scientists' time.

H. J. Dutton and V. L. Davison at the Northern utilization research laboratory, Peoria, Ill., adapted the soldering gun for reacting oil with ozone to locate unsaturation (fewer hydrogen atoms than the molecule can hold), in vegetable oils.

In their method, ozone passes through oil in a small, U-shaped tube on the soldering gun. When the gun is triggered, the tube is heated and the ozonized oil is vaporized and injected through a needle on the gun into a gas chromatograph.

In the old method, oil was oxidized in solution. Products of this reaction were recovered and converted into other products that could be identified by gas chromatography. Losses of products varied and results were not as precise as with the new method.

The microreactor also has been used to determine the fatty-acid composition of vegetable oils. It can be used to hydrogenate (react with hydrogen), minute quantities of these oils.

A technician injects a sample into one end of a U-shaped tube. The sample is vaporized in the tube and expelled through the long needle into a gas chromatograph. (Photo No. PN–1405)

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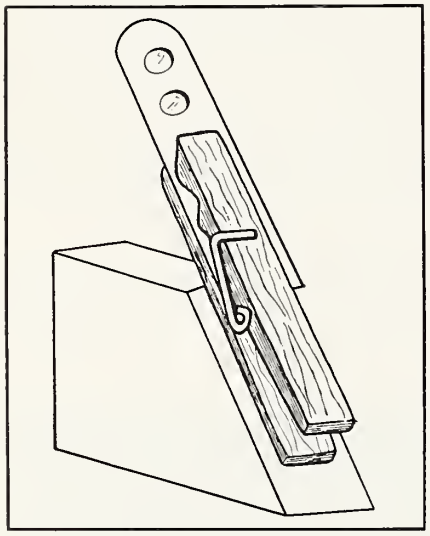
AGRISEARCH NOTES

Trap for Pine Pollen

A clothespin, a plastic tag, and a piece of cellulose tape—put together right, they make a trap for pine tree pollen.

Developed by scientists at the Forest Service's Southern Forest Experiment Station, Asheville, N.C., the clothespin trap is now being used in pine breeding research at Blacksburg, Va. With it, pollen counts are as accurate as with any other method.



In tree breeding programs, an area is planted with inherently superior trees such as pine which, ideally, should be pollinated by other selected trees in the stand. But foreign pollen carried by the wind can enter the area and also pollinate the trees. Pollen traps are necessary to determine the amount of foreign pollen that enters so that seed can be certified for purity.

During the last 10 years, several pollen traps have been tried but vaseline-coated glass slides were most often used because the materials were easily obtained.

To make the clothespin trap, a scientist punches two holes at one end of a commercial nursery tag and sticks cellulose tape on one side of the tag so it is exposed through both holes. He clamps the other end of the tag in a clothespin fastened to a tree at a 45° angle. The pollen collects on the sticky tape.

Simple and rugged, the clothespin traps are cheaper and easier to assemble and easier to mark than vaseline-covered glass slides. They do not break in handling and can be used many times without the time-consuming cleaning needed by glass slides.

FS scientists found also that pollen counts are much easier to make on the tags. The pollen stands out in bold relief—its bright yellow color contrasts with the indeterminate colors of pine dust particles and other pollens. On glass slides, however, no color distinction is apparent because the grains sink into the vaseline which destroys the color. (Photo No. PN–1406)

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

Wet Hiding Place

A wet bathing suit turned out to be a unique—but not foolproof—place to hide the marijuana which a young woman recently tried to smuggle into the U.S. from Mexico.

While examining baggage for foreign plant and animal pests at Laredo, Tex., agricultural inspector J. E. Ragsdale looked into a bag which the young lady said contained only a wet bathing suit and other personal items. Wrapped in the wet bathing suit, he found nine small rolls of marijuana in a plastic bag, a plastic bottle containing more marijuana, and other drugs.

This interception earned Ragsdale a second commendation from the Customs Bureau. Previously, he was commended for helping in the largest seizure of heroin ever made on the Mexican border and the second largest in U.S. history.

During a routine inspection at Laredo in 1963, Ragsdale became suspicious when he found the rear seat of an automobile unusually hard. He called in Customs officials and together they discovered a total of 76 pounds of pure heroin, worth millions of dollars on the illegal drug market, pushed up under the seat and in other places in the car.

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